Claims

What is claimed is:

1. A structure-guided automatic alignment system for image processing comprising:
   (a) means to receive an image input;
   (b) means to receive an application domain structure input;
   (c) a structure estimation module having an estimated structure output processes the image input and the application domain structure input.

2. The system of claim 1 further comprises an alignment decision module that receives the estimated structure and the application domain structure inputs and having an alignment parameter output.

3. The system of claim 1 further comprises a structure alignment module that receives the alignment parameter input and the application domain structure input and having a structure alignment output.

4. The system of claim 1 wherein the application domain structure is specified using a caliper method.

5. The caliper method of claim 4 further comprises a directional box caliper.

6. The caliper method of claim 4 further comprises a circle caliper.

7. The caliper method of claim 4 further comprises an arc caliper.

8. The system of claim 1 wherein the structure estimation module comprises
   (a) a preprocessing module that receives the image input having a pre-processed image output;

(b) A distributed estimation module that receives the pre-processed image and application domain structure and having an estimated structure output.

9. The structure estimation module of claim 8 wherein the preprocessing module performs edge detection.

10. The structure estimation module of claim 8 wherein the distributed estimation module further comprises
    (a) a sub-region generation module having a sub-regions output;
    (b) a robust structure-guided estimation module that receives a sub-regions output having an estimated structure output.

11. A structure estimation module comprising
    (a) means to receive an image input;
    (b) means to receive an application domain structure input;
    (c) a preprocessing module that receives the image input having a pre-processed image output;
    (d) a distributed estimation module that receives the pre-processed image and application domain structure inputs having an estimated structure output.

12. The structure estimation module of claim 11 wherein the preprocessing module performs a feature extraction such as edge detection.

13. The structure estimation module of claim 11 wherein the distributed estimation module comprises
    (c) a sub-region generation module having a sub-region output;
    (d) a robust structure-guided estimation module that receives the sub-region output having a feature parameter output.

14. The distributed estimation module of claim 13 wherein the robust structure-guided estimation module receives a box caliper input.

15. The distributed estimation module of claim 13 wherein the robust structure-guided estimation module receives a circle caliper input.

16. The distributed estimation module of claim 13 wherein the robust structure-guided estimation module receives an arc caliper input

17. The box caliper robust structure-guided estimation module of claim 14 comprises:

(a) means to perform row-wise robust feature direction estimation and weight adjustment having an adjusted weight output;

(b) means to perform column-wise robust feature direction estimation and weight adjustment having an adjusted weight output;

(c) means to perform overall robust feature direction estimation and weight adjustment having a feature direction estimation result.

18. The circle caliper robust structure-guided estimation module of claim 15 comprises:

(a) means to perform radial-wise robust center estimation and weight adjustment having adjusted weight output;

(b) means to perform angular-wise robust center estimation and weight adjustment having adjusted weight output;

(c) means to perform overall robust center estimation and weight adjustment having center estimation output.

19. The arc caliper robust structure-guided estimation module of claim 16 comprises:

(d) means to perform radial-wise robust center estimation and weight adjustment having adjusted weight output;

(e) means to perform angular-wise robust center estimation and weight adjustment having adjusted weight output;

(f) means to perform overall robust center estimation and weight adjustment having center estimation output.

20. A robust feature direction estimation and weight adjustment method for a group of box caliper sub-regions comprises:
    (a) for each sub-region, estimate the feature direction using line estimation without constraints;
    (b) for a group of sub-regions, estimate the feature direction using line estimation constrained by a parallelism relation;
    (c) compare the sub-region feature direction estimated in step (a), with the group direction estimated in step (b) and adjust weight for the sub-region based on an error function.
    (d) update and output the group of sub-regions box caliper estimate of the feature direction

21. A robust feature direction estimation and weight adjustment method for a group of circle caliper sub-regions comprises:
    (a) for each sub-region, estimate the center of a circular arc without constraints;
    (b) for a group of sub-regions, estimate the center of circular arcs constrained by the same center point;
    (c) compare the sub-region center estimated in step (a), with the group center estimated in step (b) and adjust the weight for the sub-region based on an error function.
    (d) update and output the group of sub-regions center

22. A robust feature direction estimation and weight adjustment method for a group of arc caliper sub-regions comprises the following steps:
    (a) for each sub-region, estimate the center of a circular arc without constraints;
    (b) for a group of sub-regions, estimate the center of circular arcs constrained by the same center point;

(c) compare the sub-region center estimated in step (a), with the group center estimated in step (b) and adjust weight for the sub-region based on an error function;

(d) update and output the group of sub-regions estimate for the center of circular arcs.

23. The method of claim 20 further comprising a step for re-alignment of the box caliper direction vector responsive to the group of sub-regions estimate of the feature direction output.

24. The method of claim 21 further comprising a step for re-alignment of the circle caliper center location responsive to the output of the group of sub-regions estimate of the center of circular arcs output.

25. The method of claim 22 further comprising a step for re-alignment of the arc caliper center location responsive to the output of the group of sub-regions estimate of the center of circular arcs output.